

**12<sup>TH</sup> ICCRTS**  
**“Adapting C2 to the 21<sup>st</sup> Century”**

**Title of Paper:** A Relational Database Architecture Approach for Analysis of Command, Coordination, and Communications Capabilities

**Topics:** Track 8: C2 Technologies and Systems  
Track 2: Networks and Networking  
Track 6: C2 Metrics and Assessment

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## **Abstract of Proposed Presentation to the 12 ICCRTS**

### **A Relational Database Architecture Approach for Analysis of Command, Coordination, and Communications Capabilities**

This paper represents a follow-on to a paper presented at the 2006 Command and Control Research and Technology Symposium,<sup>1</sup> wherein the “Thin Thread” analytical methodology proposed in the prior paper has been implemented in a relational database to support the conduct of a variety of analyses related to command, coordination, and communications capabilities. The database model was developed to support analysis of the capabilities of the various Departments and Agencies (D/As) of the Federal Executive Branch (FEB) to conduct their priority mission essential functions. In particular, the database explicitly models the relationships among the various major architectural components a this large-scale organizational enterprise such as:

- Missions to be accomplished
- Organizations responsible for accomplishing the missions
- Activities performed by the organizations in support of their missions
- Information content needed to support execution of mission-related activities
- Operational services needed to support execution of mission-related activities
- Data representations used to implement information exchanges
- Software applications used to implement operational services
- Hardware platforms used to host software applications
- Facilities at which organizations reside
- Communications capabilities used to link organizational facilities
- Security capabilities needed to protect communications

The model explicitly uses the components of the Federal Enterprise Architecture Reference Models as a common means of reference and employs “pick lists” to ensure consistency of contents to facilitate automated analysis of database contents. The attached set of briefing charts presented in September 2006 (Attachment A) presents an overview of the underlying model and how the FEA Reference Models are used in support of the continuity communications architecture. The model has been implemented in MS Access and SQL Server, and through changes to data table contents, is adaptable to support analysis other command, control, and communications capabilities such as those of the Department of Defense.

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<sup>1</sup> Carlos E. Martinez, Kenneth Mullins, and Karl S. Sullivan, “A Framework for Architecture-Based Planning and Assessment to Support Modeling and Simulation of Network-Centric Command and Control,” Presentation Number C-147, 2006 Command and Control Research and Technology Symposium. June 2006.

## APPENDIX A

Approved for Public Release  
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# Use of the FEA Reference Models for the Continuity Communications Architecture

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## Overview

- Project Background
- CCA Metamodel
- CCA Analytical Objectives
- Toolset Design Objectives
- Relationship to FEA Reference Models
- Use of Reference Models in Toolset
- Lessons Learned from Use of Reference Models

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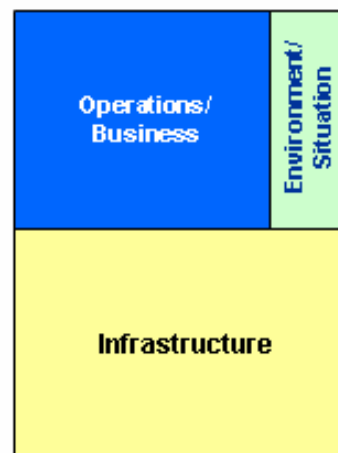
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## Continuity Communications Architecture (CCA) Project Background

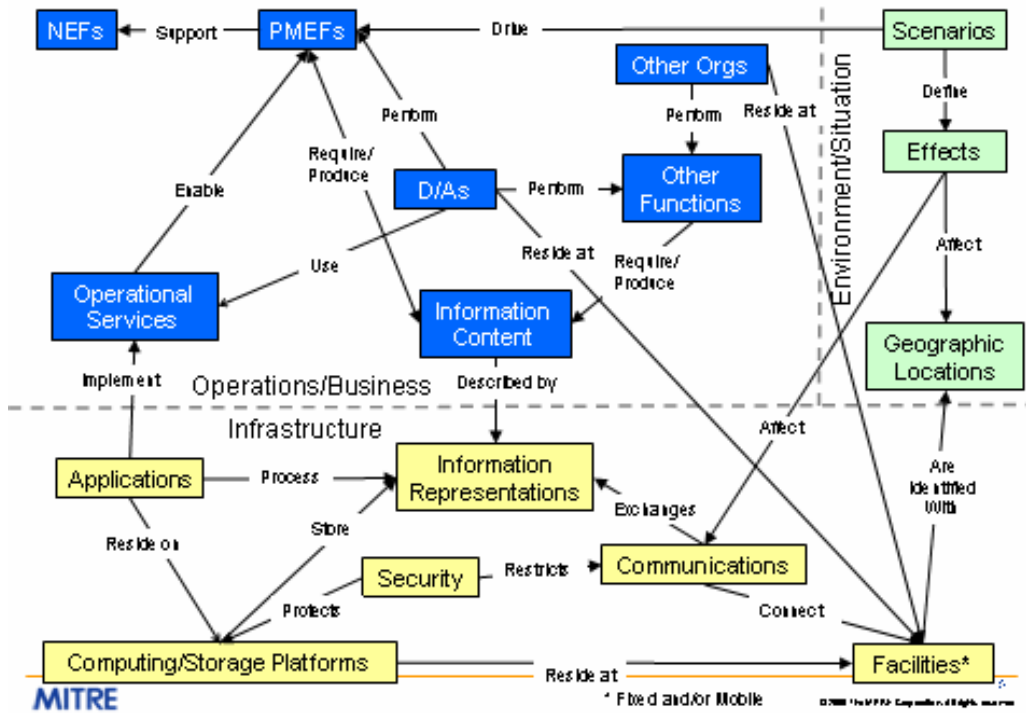
- Overall Objective
  - Ensure communications among Federal Executive Branch Departments and Agencies (D/As) to support the National Essential Functions (NEFs) under all types of national emergency situations
- Three-Phased Approach
  - Document the As-Is CCA
  - Assess the As-Is CCA for gaps in capabilities
  - Propose a To-Be CCA to close the gaps
- As-Is CCA Technical Approach
  - Develop a Metamodel for the CCA
  - Implement the Metamodel in a CCA Toolset
    - Use FEA Reference Models to the maximum extent possible
  - Use the CCA Toolset to document the As-Is CCA
    - Use "pick lists" to ensure data consistency and integrity
  - Use relational database to analyze gaps in capabilities

## CCA Metamodel Three Major Components

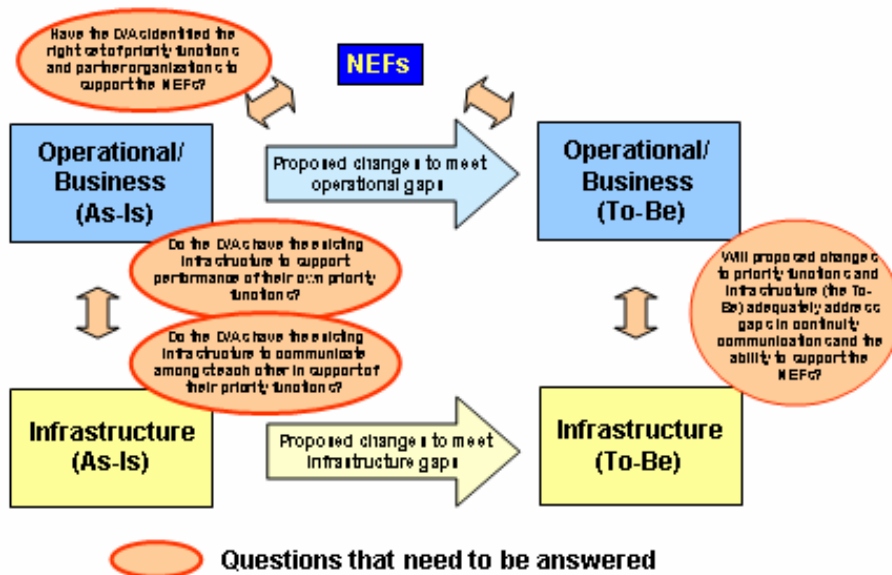
- Environment/Situation
  - The Scenarios under which the D/As must operate
- Operations/Business
  - What the D/As must do in any given Scenario
- Infrastructure
  - The facilities, communications systems, hardware/software, and other capabilities the D/As use to accomplish their priority missions



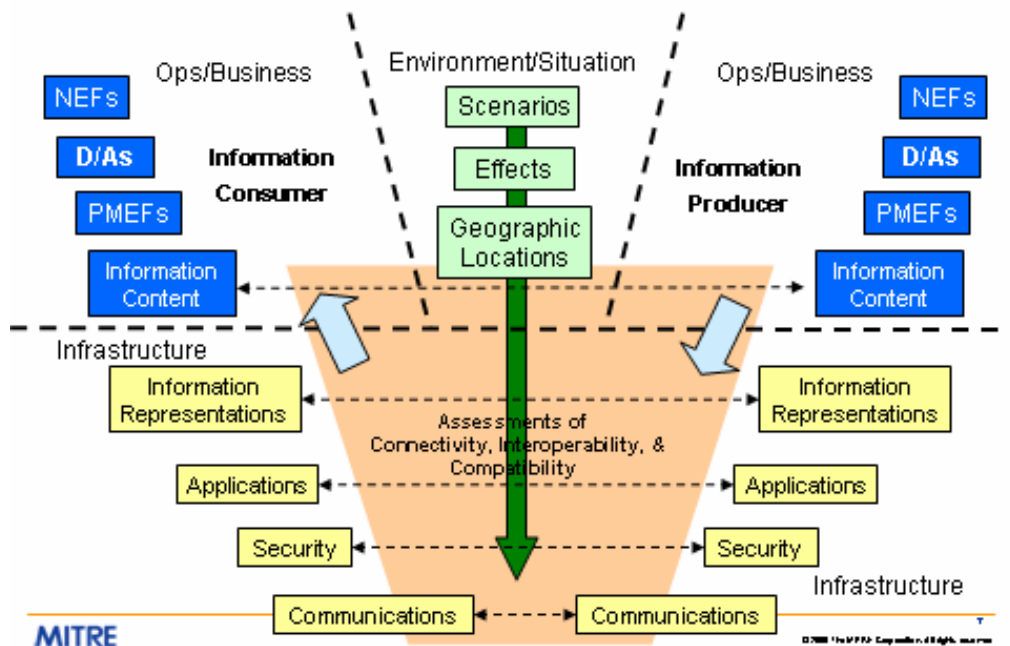
# CCA Metamodel Relationships



# CCA Analytical Objectives



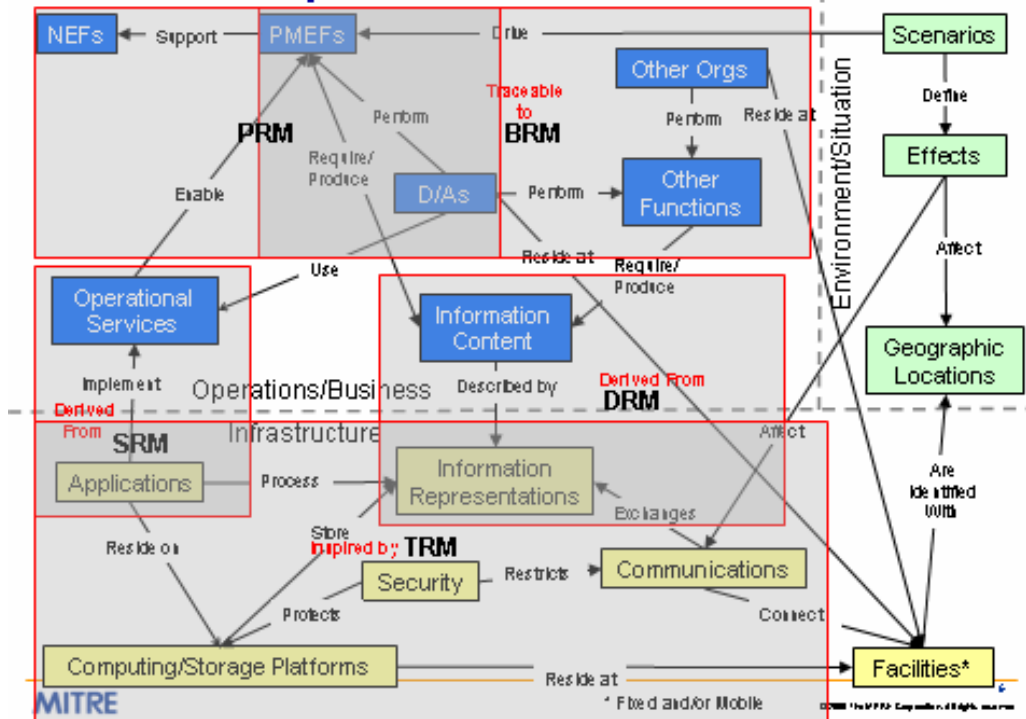
## Framework for CCA Analysis



## Toolset Design Objectives

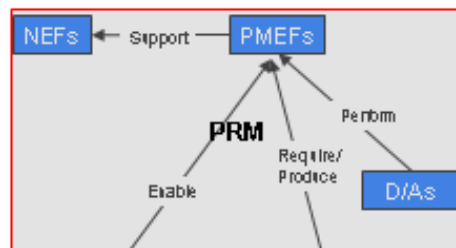
- **Ability to capture all relevant CCA information**
  - Detailed descriptions of metamodel components
  - Explicit relationships among the metamodel components
- **Ability to support analytical objectives**
  - Query and analysis capability
  - Consistency in contents
- **Ability to facilitate data collection**
  - Maximum use of standardized terminology
  - Built-in error checking
- **Traceability to FEA Reference Models**
  - Performance
  - Business
  - Data
  - Service Component
  - Technical

## Relationship to FEA Reference Models



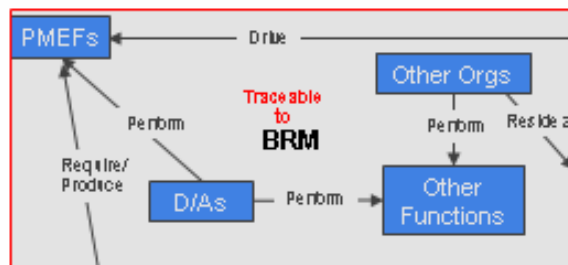
## Uses of FEA Reference Models in CCA

- **Performance Reference Model (PRM)**
  - **Operational performance (NEFs and PMEFS)**
    - Identify enterprise-level performance measures
    - E.g., timeliness of essential function startup during emergency
  - **Programmatic performance (CCA)**
    - Program Mgmt Plan specifies performance of the architecture toolset
    - Does the toolset function as intended? E.g., does it find gaps in capabilities?



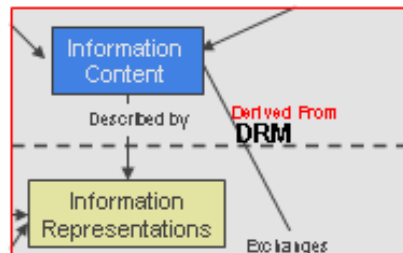
## Uses of FEA Reference Models in CCA

- **Business Reference Model (BRM)**
  - Applies to PMEFs and functions performed by other organizations in support of PMEFs
  - Supports coverage of Federal Executive Branch (FEB) Business Areas
    - Analysis compares PMEFs with Business Areas (BA) and Lines of Business (LOB) to ensure coverage of FEB responsibilities
    - Simple example: All FEB Departments and Agencies (D/As) should have disaster management (BA) including disaster repair and restore (LOB) for their services to citizens



## Uses of FEA Reference Models in CCA

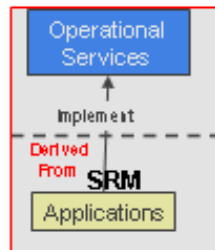
- **DRM**
  - Used for Information Content & Information Representations
  - As recommended in the FEA, begins with the first two levels of the BRM and adds a 3<sup>rd</sup> layer to describe broad types of information exchange within a line of business
    - Report of facts or statistics, guidance, direction, request for information, request for authority, financial transaction
  - Links information content with information representation
    - Shows which information standards meet operational information content needs





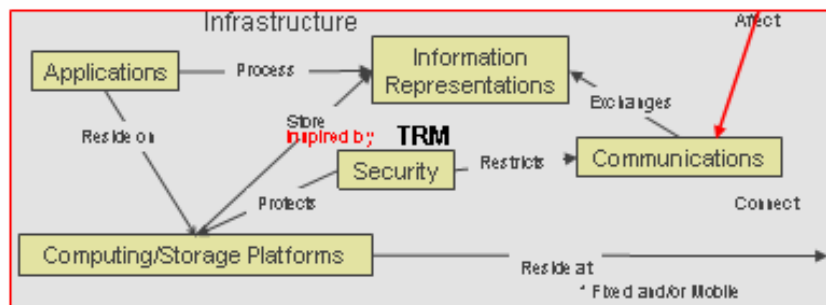
## Uses of FEA Reference Models in CCA

- SRM
  - Used directly as a pick list to identify operational services
    - Some extensions necessary
  - Used as reference for applications
  - Used to link business service needs with applications
    - Shows how applications meet operational needs



## Uses of FEA Reference Models in CCA

- TRM
  - Used as a reference model to develop pick lists for all infrastructure components
  - Via links to applications and information representation, shows how technology infrastructure meets operational needs





## Lessons Learned from Using FEA Reference Models

- FEA reference models are just that: reference models
  - Do not have to be used exactly as specified
  - They keep us from re-inventing the wheel
  - They help us standardize on terminology
  - They remind us about important aspects of a problem we may not have considered
- Hierarchies in the reference models are good, but there are places where they are difficult to use
  - Not an easy job in the first place



## Lessons Learned from Using FEA Reference Models

- Performance Reference Model (PRM)
  - The PRM is made for problems like COOP/COG
    - Responsiveness and timeliness to implement services in a crisis
  - PRM gives categories but does not provide example metrics
    - Requires creativity (re-invention) on the part of the PRM user
  - Programmatic performance is more difficult to define at the enterprise level
    - Measuring system response time is useful as long as the “right” system is responsive
    - Financial metrics such as ROI are difficult to calculate
    - How do we know we have performed?
      - *Gaps found and resolved* does not lend itself to measurement as a percentage to be tracked over time. We can however, measure this as yes or no, or as integer quantities that we would like to see increase.



## Lessons Learned from Using FEA Reference Models

- **BRM**
  - Useful for categorizing information needs and identifying relevant activities
- **DRM**
  - DRM recommendation to use top 2 levels of BRM and then add detail was helpful
    - Provided data context
    - We generalized the information content across contexts
  - CCA is not attempting detailed data modeling across the FEB
    - Too complex, too much coordination required for results time-horizon
    - CCA models information representation standards rather than data standards



## Lessons Learned from Using FEA Reference Models

- **SRM**
  - Includes good coverage of operational services
  - Confusion between FEA SRM, Service Oriented Architectures (SOA), and how they relate
    - Includes some operational services which are hard to distinguish from application services
    - Can be difficult to decide which to use where
- **TRM**
  - Provides ideas for technologies and standards that should be considered
  - Does not try to lock you into a particular set of technologies
  - Technology lists provides examples only, not enough detail within categories



# Backups

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## National Essential Functions (NEFs)

- Preserve our Constitutional form of government
- Provide visible leadership to the Nation and the world
- Defend against all enemies, foreign or domestic
- Maintain and foster foreign relations
- Protect against threats to the homeland
- Provide rapid response to emergency situations
- Protect and stabilize the nation's economy
- Provide critical Federal government services

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